

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL

GRADE 8

Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Concept 1: Number Sense

Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.

- PO 1. Locate rational numbers on a number line.
- PO 2. Identify irrational numbers.
- PO 3. Classify real numbers as rational or irrational.

Concept 2: Numerical Operations

Understand and apply numerical operations and their relationship to one another.

- PO 1. Select the grade-level appropriate operation to solve word problems.
- PO 2. Solve word problems using grade-level appropriate operations and numbers.
- PO 3. Determine the square of an integer.
- PO 4. Determine the square root of an integer.
- PO 5. Identify squaring and finding square roots as inverse operations.
- PO 6. Apply grade-level appropriate properties to assist in computation.
- PO 7. Apply the symbols " $\sqrt{\quad}$ " to represent square root, " \pm " to represent roots, and " $\{\}$ " as grouping symbols.
- PO 8. Use grade-level appropriate mathematical terminology.
- PO 9. Calculate the missing value in a percentage problem.
- PO 10. Convert standard notation to scientific notation, and vice versa.
- PO 11. Simplify numerical expressions using the order of operations with grade- appropriate operations on number sets.

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Concept 3: Estimation

Use estimation strategies reasonably and fluently.

- PO 1. Solve grade-level appropriate problems using estimation.
- PO 2. Use estimation to verify the reasonableness of a calculation (e.g., Is 32 the square root of 64?).
- PO 3. Express answers to the appropriate place or degree of precision (e.g., time, money).
- PO 4. Verify the reasonableness of estimates made from calculator results within a contextual situation.

Strand 2: Data Analysis, Probability, and Discrete Mathematics

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Concept 1: Data Analysis (Statistics)

Understand and apply data collection, organization and representation to analyze and sort data.

- PO 1. Formulate questions to collect data in contextual situations.
- PO 2. Construct box-and-whisker plots.
- PO 3. Determine the appropriate type of graphical display for a given data set.
- PO 4. Interpret box-and-whisker plots, circle graphs, and scatter plots.
- PO 5. Answer questions based on box-and-whisker plots, circle graphs, and scatter plots.
- PO 6. Solve problems in contextual situations using the mean, median, mode, and range of a given data set.
- PO 7. Formulate reasonable predictions based on a given set of data.
- PO 8. Compare trends in data related to the same investigation.
- PO 9. Solve contextual problems using scatter plots, box-and-whiskers plots, and double line graphs of continuous data.
- PO 10. Evaluate the effects of missing or incorrect data on the results of an investigation (e.g., Susie's teacher recorded a 39 instead of a 93 for her last quiz, what will happen to Susie's average?).
- PO 11. Identify a line of best fit for a scatter plot.
- PO 12. Distinguish between causation and correlation.

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Concept 2: Probability

Understand and apply the basic concepts of probability.

- PO 1. Determine the probability that a specific event will occur in a 2-stage probability experiment.
- PO 2. Solve contextual situations using probability (e.g., If the probability of Michelle making a free throw is 0.25, what is the probability that she will make three free throws in a row?).
- PO 3. Predict the outcome of a grade-level appropriate probability experiment.
- PO 4. Record the data from performing a grade-level appropriate probability experiment.
- PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.
- PO 6. Distinguish between independent and dependent events.
- PO 7. Compare the results of two repetitions of the same grade-level appropriate probability experiment.

Concept 3: Discrete Mathematics – Systematic Listing and Counting

Understand and demonstrate the systematic listing and counting of possible outcomes.

- PO 1. Determine all possible outcomes involving the combination of two or more sets of objects (e.g., If you roll a six-sided number cube 4 times, how many possible outcomes are possible?).
- PO 2. Determine all possible arrangements given a set (e.g., How many ways can you arrange a set of 7 books on a shelf?).

Concept 4: Vertex-Edge Graphs

Understand and apply vertex-edge graphs.

- PO 1. Solve contextual problems represented by vertex-edge graphs.

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Strand 3: Patterns, Algebra, and Functions

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Concept 1: Patterns

Identify patterns and apply pattern recognition to reason mathematically.

- PO 1. Communicate a grade-level appropriate iterative or recursive pattern, using symbols or numbers.
- PO 2. Extend a grade-level appropriate iterative or recursive pattern.
- PO 3. Solve grade-level appropriate iterative or recursive pattern problems.

Concept 2: Functions and Relationships

Describe and model functions and their relationships.

- PO 1. Describe the rule used in a simple grade-level appropriate function (e.g., T-chart, input/output model).
- PO 2. Distinguish between linear and nonlinear functions, given graphic examples.
- PO 3. Determine whether a graph or table is related to a given equation of the form $y=ax^2$ where 'a' is a natural number.
- PO 4. Identify independent and dependent variables for a contextual situation.

Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

- PO 1. Evaluate algebraic expressions by substituting rational values for variables [e.g., $2(ab+ac+bc)$, when $a = 2$, $b = 3/5$, and $c = 4$].
- PO 2. Use variables in contextual situations.
- PO 3. Translate a written sentence or phrase into an algebraic equation or expression, and vice versa (e.g., Three less than twice a number is $2n-3$).
- PO 4. Translate a sentence written in context into an algebraic equation involving two operations.
- PO 5. Translate a contextual situation into an algebraic inequality (e.g., Joe earns more than \$5.00 an hour; therefore, $x > 5$).
- PO 6. Identify an equation or inequality that represents a contextual situation.
- PO 7. Solve one-step equations with rational numbers as coefficients or as solutions.
- PO 8. Solve one-step equations that model contextual situations.

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PO 9. Solve two-step equations with rational coefficients and integer solutions (e.g., $3x + 5 = 11$, $4x - 20 = 8$).

PO 10. Graph an inequality on a number line.

PO 11. Solve a simple algebraic proportion.

PO 12. Solve applied problems using the Pythagorean theorem.

Concept 4: Analysis of Change

Analyze change in a variable over time and in various contexts.

PO 1. Identify the slope of a line as the rate of change (the ratio of rise over run).

Strand 4: Geometry and Measurement

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Concept 1: Geometric Properties

Analyze the attributes and properties of 2- and 3- dimensional shapes and develop mathematical arguments about their relationships.

PO 1. Draw a model that demonstrates basic geometric relationships such as parallelism, perpendicularity, similarity/proportionality, and congruence.

PO 2. Draw 3-dimensional figures by applying properties of each (e.g., parallelism, perpendicularity, congruency).

PO 3. Recognize the 3-dimensional figure represented by a net.

PO 4. Represent the surface area of rectangular prisms and cylinders as the area of their net.

PO 5. Draw regular polygons with appropriate labels.

PO 6. Identify the properties of angles created by a transversal intersecting two parallel lines (e.g., corresponding angles are congruent).

PO 7. Recognize the relationship between inscribed angles and intercepted arcs.

PO 8. Identify tangents and secants of a circle.

PO 9. Determine whether three given lengths can form a triangle.

PO 10. Identify corresponding angles of similar polygons as congruent and sides as proportional.

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Concept 2: Transformation of Shapes

Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.

- PO 1. Identify the planar geometric figure that is the result of a given rigid transformation.
- PO 2. Model a simple transformation on a coordinate grid (e.g., Translate right four units and down two units.).

Concept 3: Coordinate Geometry

Specify and describe spatial relationships using coordinate geometry and other representational systems.

- PO 1. Use a table of values to graph a linear equation.
- PO 2. Determine the midpoint given two points on a number line.
- PO 3. Determine the distance between two points on a number line.

Concept 4: Measurement - Units of Measure - Geometric Objects

Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

- PO 1. Solve problems for the area of a trapezoid.
- PO 2. Solve problems involving the volume of rectangular prisms and cylinders.
- PO 3. Calculate the surface area of rectangular prisms or cylinders.
- PO 4. Identify rectangular prisms and cylinders having the same volume.
- PO 5. Find the measure of a missing interior angle in a triangle or quadrilateral.
- PO 6. Solve problems using ratios and proportions, given the scale factor.
- PO 7. Calculate the length of a side, given two similar triangles.

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Strand 5: Structure and Logic

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Concept 1: Algorithms and Algorithmic Thinking

Use reasoning to solve mathematical problems in contextual situations.

PO 1. Describe how to use a proportion to solve a problem in context.

PO 2. Analyze algorithms.

Concept 2: Logic, Reasoning, Arguments, and Mathematical Proof

Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.

PO 1. Solve a logic problem given the necessary information.

PO 2. Identify simple valid arguments using *if...then* statements (e.g., All squares are rectangles. If quadrilateral ABCD is a rectangle, is it a square?).

PO 3. Model a contextual situation using a flow chart.

PO 4. Verify the Pythagorean theorem using an area dissection argument.